

**A COMPARATIVE STUDY TO PROVE THE EFFECTIVENESS OF  
TYLER TWIST EXERCISE WITH DIAMOND TAPING TO IMPROVE  
WRIST EXTENSOR MUSCLE STRENGTH AND DECREASE PAIN IN  
LATERAL EPICONDYLITIS**



**Reg. No. 271410225**

**MADHA COLLEGE OF PHYSIOTHERAPY  
(AFFILIATED TO THE TAMIL NADU DR. M.G.R MEDICAL UNIVERSITY)  
GUINDY, CHENNAI, TAMIL NADU – 600 032**

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**ADVISOR**

**Prof. S. Mercy Clara, MPT. (Ortho),**  
Professor,  
Madha College of Physiotherapy,  
Kundrathur,  
Chennai – 600 069.

**EXAMINERS**

1.

2.

A Dissertation submitted to The Tamil Nadu Dr. MGR Medical University in partial  
fulfilment of the requirements for the award of the degree of

**MASTER OF PHYSIOTHERAPY**

April – 2016

## **CERTIFICATE**

This is to certify that the project title “**A comparative study to prove the effectiveness of Tyler twist exercise with diamond taping to improve wrist extensor muscle strength and decrease pain in lateral epicondylitis**” is a bonafide record done under my guidance supervision in the partial fulfilment for the degree of **MASTER OF PHYSIOTHERAPY (MPT II YEAR APRIL- 2016)** by **Mrs. S. SUGANYA (Register Number: 271410225)**  
Post Graduate Student of Madha College of Physiotherapy.

**GUIDE:**

Prof. S. MERCY CLARA, MPT. (Ortho)

**PRINCIPAL**

Prof. V. VIJAI KRISHNA, MPT., MIAP

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I express my gratitude to MY GOD ALMIGHTY for his abundant grace and mercy that has made me success in my life.

I would like to dedicate this project to my beloved parents.

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## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE NOS.
1	INTRODUCTION	1-5
2	REVIEW OF LITERATURE	6-9
3	DESIGN AND METHODOLOGY	10-19
4	DATA ANALYSIS	20-30
5	RESULTS AND DISCUSSION	31-34
6	LIMITATIONS AND SCOPE FOR FURTHER STUDY	35
7	CONCLUSION	36
8	BIBLIOGRAPHY	
9	PROFORMA	
10	APPENDICES	
11	MASTER CHART	

## LIST OF TABLES

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE NO.</b>
<b>4.1</b>	COMPARISON OF PRE TEST AND POST TEST VALUES OF NPRS, GRIP STRENGTH AND DASH IN GROUP A	21
<b>4.2</b>	COMPARISON OF PRE TEST AND POST TEST VALUES OF NPRS, GRIP STRENGTH AND DASH IN GROUP B	22
<b>4.3</b>	PAIRED T-TEST ANALYSIS OF GROUP A AND B	23
<b>4.4</b>	COMPARISON OF POST TEST SCORES OF NPRS IN GROUP A AND GROUP B	25
<b>4.5</b>	COMPARISON OF POST TEST SCORES OF NPRS IN GROUP A AND GROUP B	27
<b>4.6</b>	COMPARISON OF POST TEST SCORES OF DASH IN GROUP A AND GROUP B	29

## LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
Figure 1	APPLICATION OF DIAMOND TAPE 1	16
Figure 2	APPLICATION OF DIAMOND TAPE 2	17
Figure 3	TYLER TWIST EXERCISE 1	18
Figure 4	TYLER TWIST EXERCISE 2	19
Graph 1	COMPARISON OF PRE AND POST TEST FOR NPRS	26
Graph 2	COMPARISON OF PRE AND POST TEST FOR GRIP STRENGTH	28
Graph 3	COMPARISON OF PRE AND POST TEST FOR DASH	30

# INTRODUCTION

Upper limb plays an important role in everyone's daily life and hand is the effector organ of the upper limb, which supports it mechanically and allows it to adopt the optional position for any given action from the functional point of view<sup>1</sup>. Among the upper limb conditions, tennis elbow is one of the most significantly occurred condition<sup>2</sup>. According to Ebenezer, a painful elbow syndrome comprises lateral, medial and posterior elbow symptoms; among them the one significantly noticed is the lateral tennis elbow which results from repetitive stress<sup>3</sup>.

It is generally a work-related or sport-related pain disorder usually caused by excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist<sup>4</sup>.

Tennis elbow affects 1% to 3% of the adult population<sup>4</sup> and only 5% of people related to tennis suffer from tennis elbow<sup>6</sup>. It is a misnomer, often seen in non tennis players<sup>5</sup>, although elbow pain is found in up to 50% of tennis players, where tennis elbow is encountered in 75–80% of cases and the incidence in general practice is 4–7 per 1000 per year, with 15% of workers involved in highly repetitive jobs reporting the condition<sup>6</sup>.

Several intervention for the management of lateral epicondylitis have been described, including Corticosteroid injection, NSAIDs, Muscle stretching and Strengthening exercise, Sports Taping techniques, Cryotherapy, use of orthotic device, Manipulative technique(Mulligan's MWM), Acupuncture, Ultrasound, LASER, TENS, ESWT, Electromagnetic field and Ionization. Although conservative treatment of this condition has been the subject of numerous studies, there is no agreement as to the most effective management strategy.

Eccentric exercises have been utilized successfully in chronic painful tendinosis like Achilles, supraspinatus and patellar tendinosis<sup>7</sup>. Since the different types of tendinosis show similarities in clinical behaviour and in their histological appearance, eccentric training may help in giving pain relief and functional improvements in patients with tennis elbow<sup>8</sup>.

A new treatment for tennis elbow uses a strengthening tool called the Thera-Band FlexBar to relieve tennis elbow pain. Thera-Band Flex bars are inexpensive, portable light



equipment used for strengthening. Once the patient learned this simple exercise, they could easily perform this exercise at home independently without direct supervision or regular physiotherapy visits. Thus it helps to maintain the muscle performance and reduce the risk of re-injury and enhance the functional activities<sup>9</sup>.

It is proposed that the application of tape is a means, aims to alleviate pain, improve muscle function, and restore functional movements. Taping facilitates the compliance to exercise rehabilitation programs by minimizing the aggravation of symptoms during performance of therapeutic exercise<sup>10</sup>.

There are several taping technique exist established by different author for different purposes. Mc Connell taping is one of them, which mainly aims to reduce pain, to improve function & biomechanics<sup>11</sup>. Diamond tape could be used to facilitate the pain-free implementation of upper limb activities and exercise rehabilitation program for chronic lateral epicondylitis. Mc-Connell is the originator of this mode of taping, who stated that the main mechanism of action of this treatment is to provide pain relief that allows for improved movement and function. The taping technique for the tennis elbow is considered a useful adjunct to exercise and effective in reducing pain with improving forearm muscle activity<sup>10</sup>.

## **AIM OF THE STUDY**

The aim of the study is to prove the improvement in grip strength and pain reduction with the combination treatment of Tyler twist exercise and diamond tapping in Tennis elbow.

## **NEED OF THE STUDY:**

There are articles, which support Diamond taping for pain free grip strength and indicates that it may be an useful adjunct in the management of tennis elbow. Recent articles state that the patients who used the Thera-Band flex bar has significant effect in reducing pain, improving grip strength and enhanced functional status, in patients with lateral epicondylitis.

But there is lack of experimental data regarding the comparative effects of Tyler twist exercise and Diamond taping in patients with lateral epicondylitis. Hence, here a need was identified to compare the effectiveness with diamond taping in patients with lateral epicondylitis. Hence there is a need to compare both and provide an effective and inexpensive treatment for tennis elbow.

## **OBJECTIVE OF THE STUDY**

1. To find out effectiveness of Tyler Twist exercise alone in reducing pain and improving grip strength and hand function, in-patients with tennis elbow.
2. To find out the effectiveness of Tyler twist exercise along with diamond taping in reducing pain and improving grip strength and hand function in patients with tennis elbow.
3. To find out the effectiveness of Tyler twist exercise along with diamond taping over Tyler Twist alone in reducing pain and improving muscle strength and hand function in patients with tennis elbow.

## **OPERATIONAL DEFINITIONS**

### **Tennis elbow:**

Tennis elbow or lateral epicondylitis is a clinical condition characterized by pain and tenderness over the lateral side of elbow, difficulties in functional activities and with positive Mill's test, Cozen test or resisted middle finger extension test when examined clinically.

### **Taping:**

Taping is a therapeutic procedure, performed by using tape, attached to the skin, to physically keep the muscles in place or joints in certain position, aims to reduce pain, enhance recovery, prevent overuse and further injury.

### **Grip strength:**

Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength. Optimum sized objects permit the hand to wrap around a cylindrical diameter from one to three inches.

### **Eccentric exercise:**

An exercise in which there is overall lengthening of the muscle in response to external resistance.

### **Thera-Band Flexbar**

It is a durable resistance device with a rigid surface for enhanced grip during use. It is used to increase grip strength and upper extremity stabilization, by bending, twisting or oscillation movements.

## **HYPOTHESIS:**

### **(i) Null Hypothesis:**

There will be no significant difference with the combination treatment of Tyler twist exercise with diamond tapping for Tennis elbow.

### **(ii) Alternative Hypothesis:**

There will be significant difference with the combination treatment of Tyler twist exercise with diamond taping for Tennis elbow.

## **REVIEW OF LITERATURE**

### **1. Mani L. Gerr F. (2000):**

Pain at the wrist extensor muscles at (or) near their lateral epicondyle origin (or) pain directly over the lateral epicondyle is termed as lateral epicondylitis<sup>12</sup>.

### **2. Magee D, Nischl R. et al (2008):**

Lateral epicondylitis is a chronic overuse injury causing damage to the extensor muscles tendons of the forearm. The tendon which is most commonly involved are the extensor carpi radialis brevis, extensor digitorum and extensor carpi radialis longus<sup>13</sup>.

### **3. Norris C (1998):**

Many individuals may experience pain at the head of the radius during pronation which is due to irritation of the underlying bursa<sup>14</sup>.

### **4. Bisset L et al (2009):**

There is an annual incidence of 4-7 cases per 1000 patients in general practice and 1-3% within general population. It is a common condition that significantly impacts on the individual and society. It occurs primarily between the ages of 35 and 54 and typically affects the dominant arm in men and women, alike in activities<sup>15</sup>.

### **5. Alam (2008):**

Stated that the commonest causative factor is found at over-use of elbow or repetitive concentric and eccentric contractions of the extensor muscles, which results in biomechanical positional fault as a consequences of chronic overload of repetitive stresses (heavy lifting, repetitive hammering, scissoring, twisting, and in tennis players with backhand stroke & inadequate forearm extensor power and endurance)<sup>11</sup>.

## **6. Zeisig (2008):**

Microtrauma can occur due to fatigue after repetitive loads and can even occur if the loads are within the strength limits. Puranik (2009) stated that the possible etiologies are inflammation of the radial humeral bursa, synovium, periosteum and the annular ligament<sup>16</sup>.

## **7. Hutson (2001):**

In case of tennis players overload relates to the shake frequency, incorrect technique, particularly on the backhand and muscle imbalance or loss of flexibility<sup>17</sup>.

## **8. Tyler T F et al(2010):**

Assessed the efficacy of a novel eccentric wrist extensor exercise added to standard treatment for chronic lateral epicondylitis or tennis elbow. All outcome measures for this condition were markedly improved with the addition of an eccentric wrist extensor exercise to standard physical therapy. This novel exercise, using an inexpensive rubber bar, provides a practical means of adding isolated eccentric training to the treatment of chronic lateral epicondylitis<sup>9</sup>.

## **9. Phil Page(2010)**

Developed a novel exercise and has shown promise with patients with lateral epicondylitis. In his prospective, randomized, Quasi-control study. 22LE patients were assigned to either a standard physical therapy treatment group or a group that received standard PT with addition of novel flex bar exercise. He concluded that, this clinical suggestion demonstrated an excellent example of true “evidence-based practice” in physical therapy<sup>18</sup>.

## **10. Gretchen Reynolds (2009) and Crystal Phend (2009):**

This study also noted the efficacy of Tyler twist exercise in the treatment of chronic tennis elbow<sup>19</sup>

**.11 Bill Vicenzino et al(2003):**

Did a study, on initial effects of elbow taping on pain-free grip strength and pressure pain threshold and found effectiveness of diamond taping technique on pain free grip strength in individuals with chronic lateral epicondylitis<sup>10</sup>.

**12 Jones (2009):**

Taping is used in association with exercise program by many physiotherapists in the purpose of restoring functional movement patterns by relieving pain<sup>2</sup>.

**13. Lillian Albert Zaky (2013)**

This study also noted the immediate effect of Diamond taping on wrist extensor strength, and pain in patients with tennis elbow and has concluded that this method of treatment may be useful in the management of this condition during exercise and functional rehabilitation<sup>20</sup>.

**14 Boonstra M(2008):**

Did a study to determine the reliability and validity of the Visual Analogue Scale for disability in patients with chronic musculoskeletal pain and they concluded that reliability of the VAS for disability is moderate to good and a strong correlation with the VAS for pain<sup>21</sup>.

**15. Bohannon RW(1988):**

In his study, he measured the validity of hand-grip dynamometry for upper extremity strength impairment in home care patients and the findings support the construct validity of hand-grip dynamometry for characterizing upper extremity strength impairment<sup>22</sup>.

**16. Takasaki et al (2007):**

Stretching exercises is often included in the standard physiotherapy treatment for TE (tennis elbow). Maximal muscle strain on the ECRB is obtained with the elbow in extension, fore arm in pronation, and wrist in flexion-ulnar deviation<sup>23</sup>

.

**17. Isam Atroshi et al (2000):**

Did a study on 176 patients to determine the reliability and validity of DASH scale and concluded that DASH is a reliable and valid region – specific outcome measure. It should be a valuable test in clinical research of upper extremity musculoskeletal disorders and for clinicians managing patients with such disorders<sup>24</sup>.



## **DESIGN AND METHODOLOGY**

### **STUDY DESIGN:**

Randomized controlled clinical trial.

### **STUDY SET UP:**

- Madha Medical college and Hospital
- Prema Physiotherapy Clinic.

### **POPULATION:**

All the well oriented and well co-operative lateral epicondylitis subjects who fulfilled the inclusion criteria were included in the study.

### **SAMPLE SIZE:**

30 subjects from the population were selected through the lottery method and they were divided into two groups (Each fifteen)

**GROUP A** Tyler twist exercise.

**GROUP B** Tyler twist exercise with Diamond taping.

### **INCLUSION CRITERIA**

- Mill's test positive.
- Cozens test positive.
- Patients who had pain over the lateral epicondyle with one of the following test.
  - a. Extensor carpi radialis test [i.e. resisted middle finger extension].
  - b. Passive stretch of wrist extensor.

- Participant who don't involve in any other form of treatment during their involvement in the study.
- Patient reporting unilateral involvement.
- Patient who have pain more than six weeks.

## **EXCLUSION CRITERIA**

- Allergies to adhesive tape.
- Any upper limb neurological abnormalities on physical examination (Ex: Cervical neuropathy)
- A concomitant upper limb orthopaedic condition or any concurrent treatment.
- Limitation in ROM in the involved hand.

## **VARIABLES OF THE STUDY**

### **i. INDEPENDENT VARIABLE**

- Tyler twist exercise
- Diamond tapping.

### **ii. DEPENDENT VARIABLE**

- Pain
- Grip Strength

## **MEASUREMENT TOOLS**

- Visual Analog Scale – Pain
- Subjective disability (DASH) – Questionnaire
- Hand held dynamometer (Wrist and finger strength)

## **DURATION OF THE STUDY**

Patients with tennis elbow were assigned randomly to four week protocol.

# METHODOLOGY

## MATERIALS USED

- Thera Band Flex Bar
- Mc Connell's Rigid tape
- Sand Bags and Dumbbells'
- NPRS
- Hand Held Dynamometer
- DASH Questioner

Patients who fulfilled the inclusion criteria after an initial assessment and informed consent, were assigned in to two groups A and B, based on simple random sampling .Pre-test and Post-test evaluation were done before and after treatment, which includes pain assessment using NPRS , grip strength using hand held dynamometer DASH questioner.

## Group A

Group A subjects received Tyler twist exercise.

## TYLER TWIST EXERCISE PROTOCOL (10 min)

The Tyler twist exercise is performed using a Thera –band Flex Bar which consist of different resistance.

Yellow takes 6 lb of force

Red - 10 lb

Green - 15 lb

Blue - 25 lb

The selection of the Flex Bar and progression was individualised according to the patients tolerance and performance.

- Each subject for the Tyler Twist protocol will be given 3 sets of 15 repetitions of eccentric strengthening provided with a Thera-band Flex Bar to perform the exercise.
- The strengthening exercise will be performed in a seated or a standing position.
- The elbow will be flexed at  $90^0$  and forearm will be neutral (mid prone).
- Subject will hold one end of rubber bar in involved hand with maximum wrist extension and grasp the other end of rubber bar by non-involved hand.
- Then twist the rubber bar by flexing the non-involved wrist while holding the involved wrist in extension.
- Bring arms in front of the body with elbows in extension while maintaining the twist in rubber bar by holding with non-involved wrist in full flexion and involved wrist in full extension
- Slowly allow rubber bar to untwist by allowing involved wrist to move in to flexion (i.e., eccentric contraction of the involved wrist extensors).
- Each eccentric wrist extensor contraction lasted for 4 sec (i.e., slow reversal).
- Both upper extremities reset for subsequent repetition.
- Subjects in the Tyler Twist exercise group perform 3 sets of 15 repetitions, with 30 sec rest period between each set.
- Intensity will be increase by giving the patient a thicker rubber bar if the patient reported no longer experiencing discomfort during the exercise.
- 3 sets of 15 repetitions will be given 5 times a week, for 4 weeks.

## **Group B**

In addition to Tyler Twist exercise, Group B subjects received Diamond taping. Diamond taping was followed by Tyler Twist exercise to allow proper pain free exercise program.

### **DIAMOND TAPING:**

The elbow region (from lower end of humerus till mid-forearm) has to be shaved and the part should be dry. Now a skin toughner spray is sprayed on the skin to avoid the direct contact with the tape. The diamond taping technique consisted of 4 pieces of approximately 80-100mm long, 38mm wide, non-elastic, McConnel's tape. These were laid on skin distal to proximal in a diamond shape, applying a tractional force on soft tissues towards lateral epicondyle and perpendicular to line of the tape.

The strips overlapped at their ends and were secured with an additional 4 tape strips, giving the bulging tissue an orange peel appearance. The tape will be removed after 24 hrs of application.

### **TYLER TWIST EXERCISE PROTOCOL (10 min)**

- Each subject for the Tyler Twist protocol will be given 3 sets of 15 repetitions of eccentric strengthening provided with a Thera-band Flex Bar to perform the exercise.
- The strengthening exercise will be performed in a seated or a standing position.
- The elbow will be flexed at  $90^0$  and forearm will be neutral (mid-prone).
- Subject will hold one end of rubber bar in involved hand with maximum wrist extension and grasp the other end of rubber bar by non-involved hand.
- Then twist the rubber bar by flexing the non-involved wrist while holding the involved wrist in extension.

Bring arms in front of the body with elbows in extension while maintaining the twist in rubber bar by holding with non-involved wrist in full flexion and involved wrist in full extension.

- Slowly allow rubber bar to untwist by allowing involved wrist to move in to flexion (i.e., eccentric contraction of the involved wrist extensors).
- Each eccentric wrist extensor contraction lasted for 4 sec (i.e., slow reversal).
- Both upper extremities reset for subsequent repetition.
- Subjects in the Tyler Twist exercise group perform 3 sets of 15 repetitions, with 30 sec rest period between each set.
- Intensity will be increase by giving the patient a thicker rubber bar if the patient reported no longer experiencing discomfort during the exercise.
- 3 sets of 15 repetitions will be given 5 times a week, for 4 weeks.

## **APPLICATION OF DIAMOND TAPE 1**

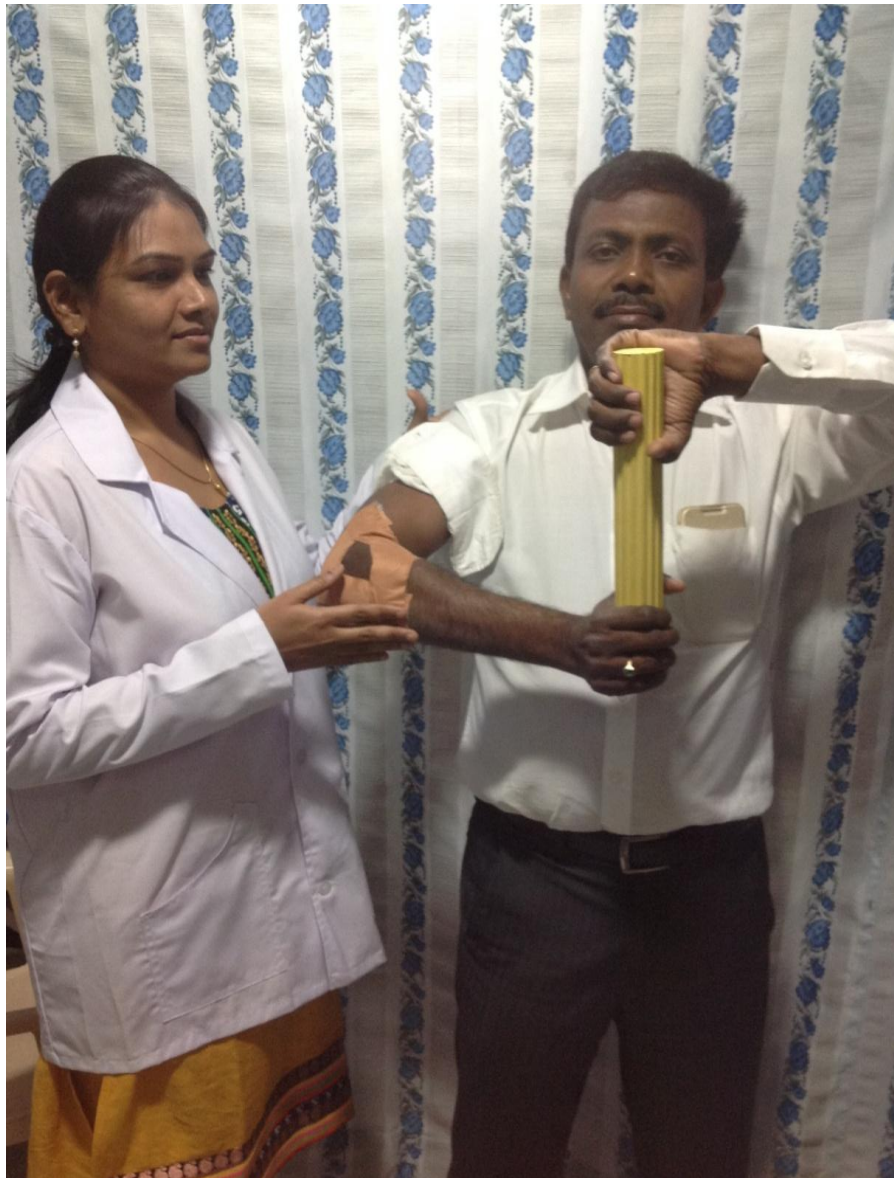


## **APPLICATION OF DIAMOND TAPING 2**





## TYLER TWIST EXERCISE 1



## TYLER TWIST EXERCISE 2



## DATA ANALYSIS

- Statistical analysis was done using SPSS version 17.00

### STATISTICAL DATA ANALYSIS TECHNIQUE

In Group A, Group B all data was expressed as mean  $\pm$  SD and was statistically analyzed using paired 't' test and independent 't' test to determine the statistical difference among the parameters at 0.5% level of significance by employing the statistical tools as given below

$$\text{Mean } \bar{x} = \frac{\sum x}{n} ; \text{ Standard deviation SD} = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$\text{Paired t-test } t_{cal} = \frac{\bar{d}}{s_d / \sqrt{n}}$$

Where,  $\bar{d}$  = mean difference;  $S_d$  = Standard deviation of difference

$$\text{Independent t - test } t_{cal} = \left| \frac{x^1 - x^2}{SE} \right|$$

$$SE = s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$\text{Where, } s = SE = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$n_1, n_2$  = Size of the samples of two groups.

**Table 4.1**

**COMPARISON OF PRE-TEST AND POST-TEST VALUES OF NPRS  
DASH AND GRIP STRENGTH IN GROUP A**

GROUP A						
VARIABLES	PRE-TEST			POST TEST		
	MEAN	S D	SEM	MEAN	S D	SEM
NPRS	6.73	1.668	0.431	1.73	0.884	0.228
GRIP STRENGTH	8.53	1.552	0.4.01	14.03	2.553	0.659
DASH	59.779	2.8136	0.7265	34.867	2.6914	0.6949

Table 4.1 shows descriptive measures of pre-test and post-test values of NPRS, grip strength and DASH in group A.

The mean value of NPRS in post-test is 1.73 with SD of 0.884 and SEM of 0.228, which is less than the mean value of pre-test 6.73 with a SD of 1.668 and SEM of 0.431.

The mean value of grip strength in post-test is 14.03 with SD of 2.553 and SEM of 0.659, which greater than the mean value of pre-test 8.53 with SD of 1.552 and SEM of 0.401.

The mean value of DASH in post-test is 34.867 with SD of 2.914 and SEM of 0.6949, which is lesser than the mean value of pre-test 59.779 with SD of 2.8136 and SEM of 0.7265.

**Table 4.2**

**COMPARISON OF PRE-TEST AND POST-TEST VALUES OF NPRS,  
DASH, AND GRIP STRENGTH IN GROUP B.**

<b>GROUP B</b>						
<b>VARIABLES</b>	<b>PRE-TEST</b>			<b>POST TEST</b>		
	<b>MEAN</b>	<b>S D</b>	<b>SEM</b>	<b>MEAN</b>	<b>S D</b>	<b>SEM</b>
NPRS	7.13	1.727	0.446	1.13	0.64	0.165
GRIP STRENGTH	8.57	1.898	0.490	20.67	1.460	0.377
DASH	59.284	3.6003	0.9296	32.294	2.1065	0.5439

Table 4.2 shows descriptive measures of pre-test and post-test values of NPRS, grip strength and DASH in group B.

The mean value of NPRS in post-test is 1.13 with SD of 0.640 and SEM of 0.165, which is less than the mean value of pre-test 7.13 with SD of 1.727 and SEM of 0.446.

The mean value of grip strength in post-test is 20.67 with SD of 1.460 and SEM of 0.377, which is greater than the mean value of pre-test 8.57 with SD of 1.898 and SEM of 0.490.

The mean value of DASH in post-test is 32.294 with SD of 2.1065 and SEM of 0.5439, which is lesser than the mean value of pre-test 59.284 with SD of 3.6003 and SEM of 0.9296.

**Table 4.3****PAIRED T-TEST ANALYSIS OF GROUP A AND GROUP B**

<b>GROUP B</b>								
<b>VARIABLES</b>		<b>PAIRED DIFFERENCE</b>						
		<b>MEAN</b>	<b>S D</b>	<b>SEM</b>	<b>95% CONFIDENTIAL INTERVAL</b>		<b>DIFF</b>	<b>T</b>
					<b>LOWER</b>	<b>UPPER</b>		
NPRS	GROUP A	5.000	1.309	0.338	4.275	5.725	14	14.790
	GROUP B	6.000	1.309	0.338	5.275	6.725	14	17.748
GRIP STRENGTH	GROUP A	-5.500	2.994	0.773	-7.158	-3.842	14	-7.115
	GROUP B	-12.100	1.882	0.486	0.486	-13.142	14	-24.897
DASH	GROUP A	24.9120	3.6828	0.9509	22.8725	26.9515	14	26.199
	GROUP B	26.9900	8.3543	1.1243	24.5787	29.4013	14	24.007

The above table shows the statistical outcome of paired “T” test analysis of NPRS, grip strength, and DASH in group A and B.

The mean value of NPRS in group A is 5.000 with SD of 1.309 and SEM of 0.338, when compared to Group B, the mean value of group B is 6.000, which is increased, but the SD of 1.300 and SEM of 0.338 shows the same value as group A.

The change in 95% of confident interval in group A is 4.275 – 5.725 and group B is 5.275 – 6.725.

The mean value of grip strength in group A is 5.500 with SD of 2.994 and SEM of -7.158 when compared to group B, the mean value of group B is decreased by -12.100 with SD of 1.882 and SEM of 0.486.

The change in 95% confident interval in group A is -7.158 - -3.842 and 0.486 to -13.142 in group B.

The mean of DASH in group A is 24.9120 with SD of 2.994, which is greater than group B with a mean value of 26.990 and SD 3.6828, but the SEM of group A is 0.9509 which is lesser than group B with SEM of 1.1243.

The change in 95% of confident interval in group A is 22.8725 – 26.9515 and 24.5787 – 29.4013 in group B.

**Table 4.4**

**COMPARISION OF POST SCORE OF NPRS OF GROUP A AND GROUP B**

<b>GROUPS</b>	<b>MEAN</b>	<b>S D</b>	<b>SEM</b>	<b>MEAN DIFF</b>	<b>95% CONFIDENCIAL INTERVAL</b>	<b>T VALUE</b>	<b>P Value</b>
<b>GROUP A</b>	1.73	0.884	0.228	0.6	0.2	2.130	0.00
<b>GROUP B</b>	1.13	0.64	0.165	0.6	1.180	2.130	0.00

The above table shows the statistical scores outcome measures of post-test scores of NRPS group A and group B.

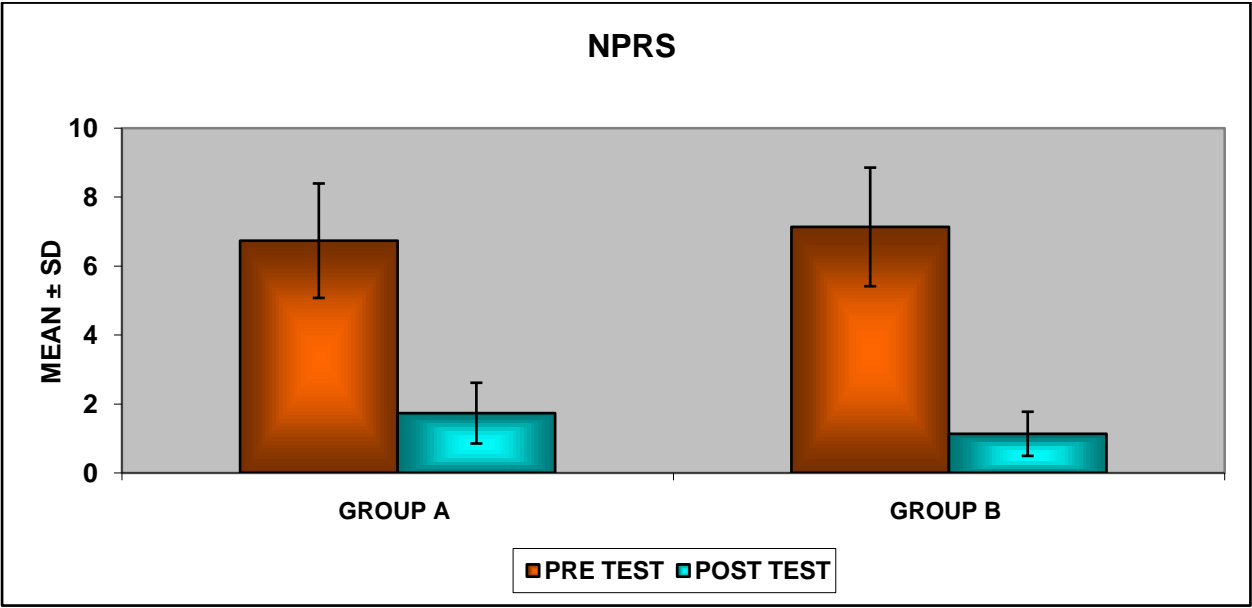
The NRPS of group A has a mean value of 1.73 and group B has a mean value of 1.13 with mean difference of 0.600.

The 95% of confident interval is 0.20 – 1.180 with a T-value of 2.130, which is statistically significant with  $P(<0.005).000$ .



**GRAPH 1**

**COMPARISION OF PRE AND POST TEST FOR NRPS**



**Table 4.5**

**COMPARISON OF POST SCORE OF GRIP STRENGHT IN  
GROUP A AND B**

<b>GROUPS</b>	<b>MEAN</b>	<b>S D</b>	<b>SEM</b>	<b>MEAN DIFF</b>	<b>95% CONFIDENCE INTERVAL</b>	<b>T VALUE</b>	<b>P Value</b>
<b>GROUP A</b>	14.03	2.553	0.659	-6.633	8.189	-8.736	0.00
<b>GROUP B</b>	20.67	1.46	0.377	-9.633	-5.060	-8.736	0.00

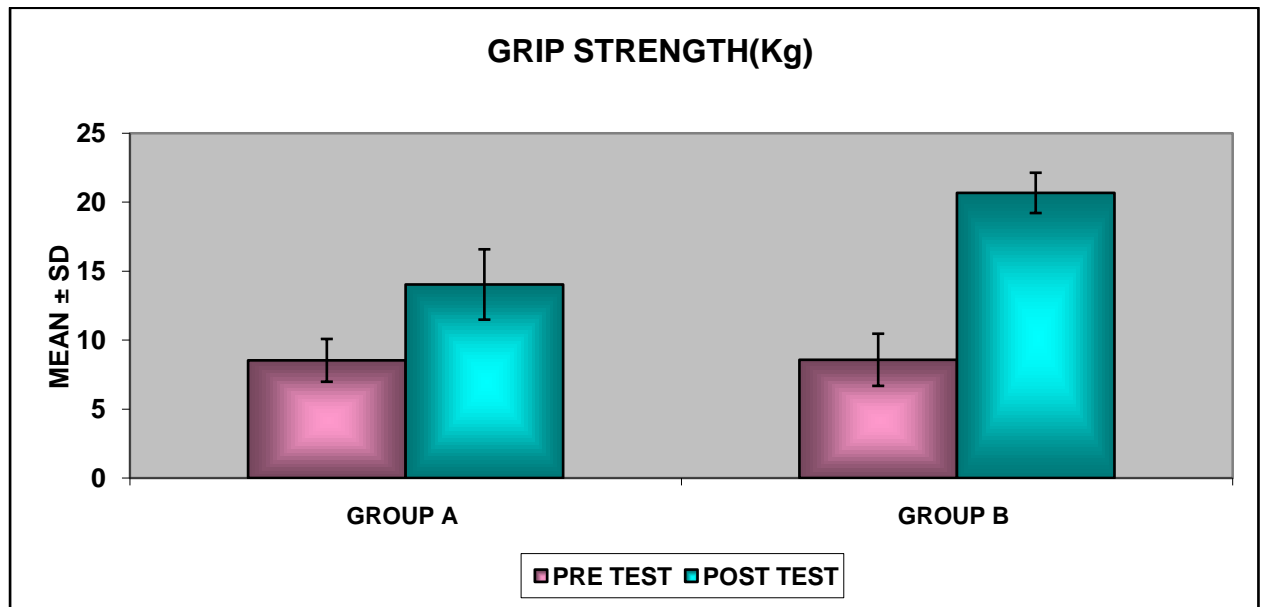
The above table shows the statistical score outcome measures of post-test scores of grip strength of group A and group B.

The grip strength of group A has a mean value of 14.03 and group B has a mean value of 20.67 with a mean difference of -6.633.

The 95% of confident interval is 8.189 - -5.060 with a T-value of -8.736, which is statistically significant with P (<0.005).000..

## GRAPH 2

### PRE AND POST TEST COMPARISION 0F GRIP STRENGTH



**Table 4.6**

**COMPARISION OF POST TEST SCORES OF DASH OF GROUP A AND B**

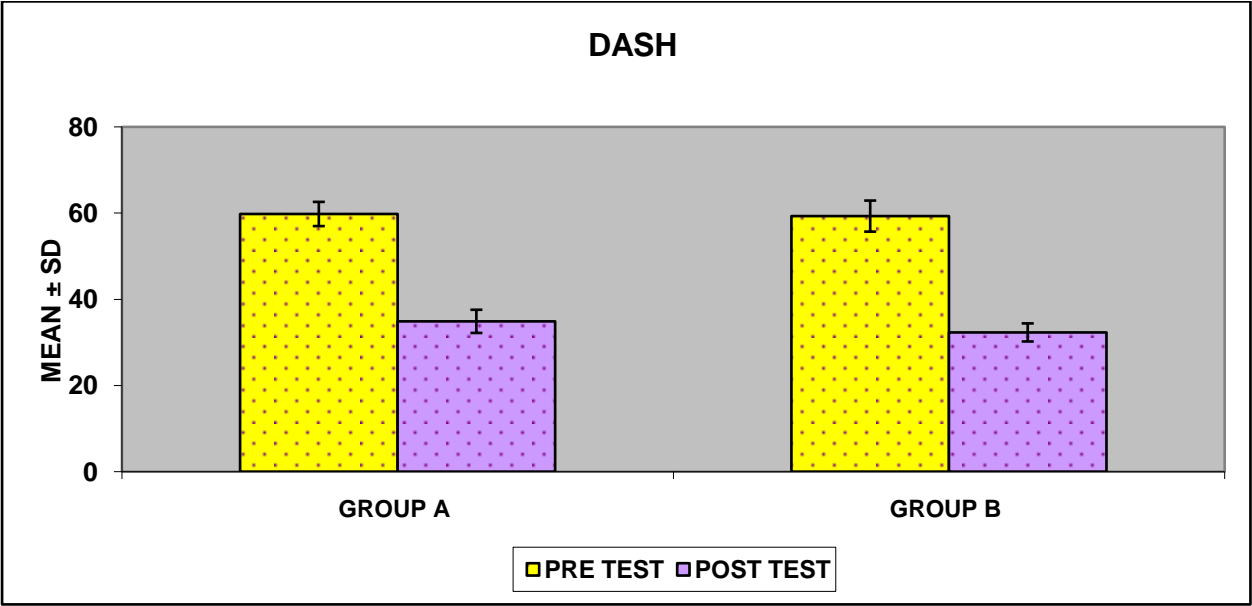
<b>GROUPS</b>	<b>MEAN</b>	<b>S D</b>	<b>SEM</b>	<b>MEAN DIFF</b>	<b>95% CONFIDENCE INTERVAL</b>	<b>T VALUE</b>	<b>P Value</b>
<b>GROUP A</b>	34.867	2.6914	0.695	2.5733	0.7657	2.916	0.00
<b>GROUP B</b>	32.294	2.3065	0.544	2.5733	4.3857	2.916	0.00

The above table shows the statistical score outcome measure of post-test scores of DASH of group A and B.

The DASH of group A has a mean value of 34.867 and group B has a mean value of 32.294 with a mean difference of 2.5733. The 95% of confident interval is 0.7657 – 4.3857 with a T-value of 2.916, which is statistically significant with P (<0.005).000.

**GRAPH 3**

**PRE AND POST TEST COMPARISION OF DASH**



## **RESULT AND DISCUSSION**

### **RESULTS:**

- The post test score of NPRS, Grip Strength and DASH shows, improvement in both the groups
- The post scores in case of NPRS in both groups A and B show almost same state of improvement with a minimal difference.
- The post test score of Grip Strength and DASH shows good improvement in Group B when compared to group A
- Statistical supports also state that Tyler twist exercise with Diamond taping would be more beneficial when compared to Tyler twist alone.
- Group B shows better improvement when compared to Group A.

## DISCUSSION

Lateral epicondylitis is one of the conditions which can be treated by a wide variety of physiotherapy methods. It is still difficult to formulate all proof guidelines for the management of lateral epicondylitis. Various methods of treatment exist with own claims of success without any attempts of comparing the maximal effective methods. The objective of this study was to compare the effectiveness of Tyler twist exercise with diamond taping in the treatment of chronic lateral epicondylitis.

D' Stasinopoulos, in his study has mentioned that there are three forms of musculotendinous contractions (i) Isometric (ii) Concentric, and (III) Eccentric. Most therapists agree that the eccentric contractions appear to have the most beneficial effects for the treatments of LET. In case of LET, eccentric training should be performed for the extensor tendons of the wrist, including the ECRB tendon, which LET most commonly affects.

The three principles of eccentric exercises are (i) Load, (ii) Speed and (III) Frequency:

Increase in load according to the patient's symptoms clearly subjects the tendons to greater stress and forms the bases for the progression of the program.

Increase in speed, thus increase the load of tendon to better stimulate the mechanism of injury<sup>23</sup>

.Phil Page, in his study, has mentioned that eccentric exercise effectively "lengthened" the muscle tendon complex resulting in structural remodelling of the tendon with hypotrophy and increased tensile strength of the tendon<sup>15</sup>.

Clinicians understanding the positive effects of eccentric exercise on tendinopathies used an existing clinical tool (the Flex Bar) to develop an "evidence – led" intervention that could be applied in today's outpatient physical therapy environment.

Tyler says, "You can load a tendon so much more eccentrically" than with concentric exercises. Eccentric contractions require the muscle to work against a force, in this case the coiled bar. Eccentric exercise may also provide neuromuscular benefits

through central adaptations of both agonist and antagonist muscles; therefore, tennis elbow exercise may provide both structural and functional benefit during tendinopathy rehabilitation<sup>9</sup> Research published in the journal of shoulder and elbow surgery found that the Tyler twist exercise using the Thera-band FlexBar is effective at reducing pain associated with tennis elbow.

The Tyler twist exercise promote an emphasis on home based inexpensive treatment as compared to clinically based use of more expensive devices.

Bill Vicenzino, in his study has suggested that clinically in musculoskeletal conditions, by minimizing the aggravation of symptoms during the performance of therapeutic exercise, use of taping technique may facilitate the compliance to exercise rehabilitation programs. He also suggested that diamond taping may be a useful adjunct in management of lateral epicondylitis where it would serve to optimize the imposed loads on the forearm muscles during exercise and functional rehabilitation<sup>10</sup>.

Lilian Albert Zaky has proved in his study that the application of taping technique(diamond tape)improved wrist extension isometric strength and pain immediately after application in patients with lateral epicondylitis<sup>13</sup>.

Today's internet based society will continue to challenge rehabilitation provider to support and practice in an evidence – based practice, as patients learn about successful treatment and look to their physical therapist to provide them.

Hence, this study has focused on a combination treatment of diamond taping along with Tyler twist exercise to enhance the rehabilitation program for tennis elbow and to formulate an evidence based practice.

Results indicate that there is significant improvement in pain, grip strength and functional performance in patients with Chronic Lateral Epicondylitis at the end of 4 weeks in both the two groups, after Tyler Twist alone in Group A, and Tyler Twist exercise with Diamond Tapping in Group B. Both treatment groups obtained successful outcome as measured by significant improvement in NPRS score, Grip Strength and DASH score after 20 sessions of intervention. There is significant difference in intensity of pain is as per NPRS, Grip Strength as per Hand Dynamometer and functional performance as per DASH between both the groups.



In this study, it was found that Tyler Twist Exercise alone and Tyler twist exercise along with Diamond Tapping were effective in reducing pain and improving Grip Strength in patients with Chronic Lateral Epicondylitis.

Although both groups show a significant reduction of pain, the Tyler twist group with diamond taping was more effective in improving grip strength in patients with Chronic Lateral Epicondylitis. This difference in improvement could be because taping disperses stresses generated by muscle contraction, thereby reducing painful inhibition and allowing the subject to contract more forcefully. Further, a possible model of mechanism of action for taping may relate to its neurophysiologic effects on the nervous system. In this neurophysiologic model, the tape may exert an effect on grip strength by primarily altering the pain perception, either locally at the elbow by inhibiting nociceptors, facilitating large afferent fibre input into the spinal cord and/or possibly stimulating endogenous process of pain inhibition as stated by Alireza Shamsoddini<sup>5</sup>.

In the study conducted by Shamsoddini, he used a modified taping technique, where patient alone and without the help of the therapist, pasted tapes on their elbows. In this study the whole procedure of Tyler-twist exercise and Diamond taping was done under the supervision of the therapist. But if the patient been trained the technique of Diamond taping as proposed by Shamsoddini<sup>5</sup>, it would be purely a cost effective treatment, with minimal assistance of the therapist.

Henceforth this study has demonstrated, Tyler twist exercise along with Diamond tapping, was found to be more effective in patients with Chronic Lateral Epicondylitis, possibly due to the above said reasons.. This effect is similar to previous research report. as stated by Tyler<sup>9</sup> and Bill Vincezino<sup>10</sup>. So, these interventions can be applied in clinical setup in combination with conventional treatment for the better and long term improvements.

## **LIMITATION OF THE STUDY**

1. The study consists of a small quantity of patients.
2. No long term follow up was done.
3. No blinding was done.

## **SCOPE FOR FURTHER STUDY:**

1. Further study can be done with larger sample size.
2. Study can be done with long term follow up.
3. The same study can be done on acute lateral epicondylitis patients.
4. The study can be done to know the additive effect of Laser, Active Release Technique or Myofascial Release Technique along with Tyler twist technique.

## **CONCLUSION**

From the result of the study, it was concluded that after 4 weeks of both the Tyler-twist exercise alone and Tyler-twist exercise with Diamond tapping were effective in the treatment of chronic lateral epicondylitis. But Tyler twist exercise with Diamond Tapping was found superior than Tyler-twist exercise alone.

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## PROFORMA

Name :  
Age :  
Gender : Male/Female  
Occupation :  
Marital Status :  
Chief Complaints :  
Past Medical History :  
Present History :  
Personal History :  
Socio-economic History :

### VITAL SIGNS

I. Heart Rate :  
II. Pulse :  
III. Blood Pressure :  
IV. Respiratory Rate :  
V. Temperature :

## **PAIN ASSESSMENT**

Site :

Side :

Duration :

Type :

Nature :

Aggravating Factors :

Severity :

Visual Analog Scale (VAS) :

## **ON OBSERVATION**

General Observation :

Local Observation :

## **PALPATION**

Swelling :

Tenderness :

Warmth :

Crepitus :

## EXAMINATION

Muscle Power :

Muscles	Right	Left

Special Tests :

- Mill's Test
- Cozen's Test

## INVESTIGATION

1. X-Ray :
2. MRI :

VARIABLES	PRE TEST	POST TEST
NPRS		
GRIP STRENGTH		
DASH		

## PHYSIOTHERAPY MANAGEMENT

### PLAN OF TREATMENT

- Short Term Goal
- Long Term Goal

Signature of the Investigator

Signature of the Subject



## INFORMED CONSENT FORM

I ..... agree to participate in the research study conducted by Mrs S. SUGANYA, II year, MPT (Ortho), Madha College of Physiotherapy entitled **“A comparative study to prove the effectiveness of Tyler twist exercise with diamond taping to improve wrist extensor muscle strength and decrease pain in management of lateral epicondylitis”**

I acknowledge that the research study has been explained to me and I understand the agreeing to participate in the research means I am willing to,

1. Provide information about my health status to the researcher(s)
2. Allow the researcher(s) to have access to my professional records pertaining to the purpose of the study.
3. Participate in training program for duration of 6 weeks
4. Make myself available for follow up.
5. Understand and follow the home advice(s) that will be provided.

I have been informed about the purpose; procedure(s), measurement(s) and risk(s) involved in the research and my queries towards the research have been clarified.

I provide consent to the researcher to use the information, video recording(s), for research and educational purpose only.

I understand that my participation is voluntary and can withdraw at any stage of the research project.

Name of the Participant

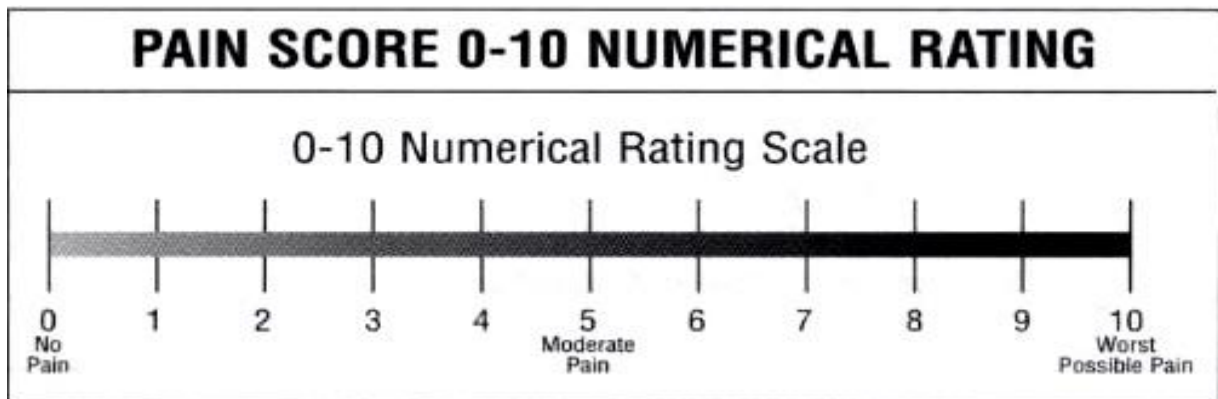
Date

Signature

## APPENDICES

### The Numeric Pain Rating Scale (NPRS)

The patient is asked to make three pain ratings, corresponding to current, best and worst pain experienced over the past 24 hours. The average of the 3 ratings was used to represent the patient's level of pain over the previous 24 hours.



## **THE DISABILITY OF ARM SHOULDER AND HAND QUESTIONER**

### **(DASH)**

The disability of arm, shoulder and hand (Dash) questioners is a self-administered region specific outcome instrument, develop to measure upper extremity disability and symptoms.

The dash consists of 30 – item disability / symptom scale.

1. The items (table-I) ask about the degree of difficulty in performing various physical activities because of an arm, shoulder and hand problems (21 items).
2. Dash also consists of 2 optional 4 items scale concerning the ability to perform sports and /or to play a musical instruments (sports/musical scale) and ability to work (works scale).
3. Each item has 5 response choice ranging from no difficulty to ranging from unable to perform the activity or very severe symptoms, and is scored on a 1- 5point scale.

DASH scale is calculated by

$$\text{DASH disability/symptoms score} = \frac{[(\text{sum of n response}) - 1] \times 25}{n}$$

Where n = no of completed responses.

## **Mill's Test:**

**Purpose:** To determine the presence of a lateral epicondylitis.

**Test Position:** Standing.

**Performing the Test:** Palpate the lateral epicondyle while passively pronating the forearm, flexing the wrist and extending the elbow. A positive test is reproduction of lateral elbow pain.

**Diagnostic Accuracy:** Unknown.

**Importance of Test:** According to Neumann, the common proximal attachment site of the wrist extensors is on or near the lateral epicondyle of the humerus and dorsal border of the ulna. The distal attachments of the extensor carpi radialis longus and brevis are the 2nd and 3rd metacarpals respectively. These muscles are responsible for wrist extension and radial deviation. The extensor carpi ulnaris attaches to the 5th metacarpal and is responsible for wrist extension and ulnar deviation. With tendinopathy, any stretch or contraction of the tissues can potentially reproduce pain. The starting position of the test (elbow flexion, wrist extension, radial deviation, and pronation) places the muscles in a shortened position. The combined motions of elbow extension, wrist flexion, pronation, and palpation of the origin of the muscles reproduce the patient's symptoms, by placing a stretch on the tissues.

## **Cozen's Test**

**Purpose:** To determine the presence of lateral epicondylitis.

**Test Position:** Standing or sitting.

**Performing the Test:** Stabilize the patient's forearm and instruct the patient to make a fist, pronate the forearm, radially deviate, and extend the wrist. Next the clinician palpates the lateral epicondyle with the stabilizing hand and applies a flexion force against the patient's resistance. A positive test is reproduction of lateral elbow pain.

Diagnostic Accuracy: Unknown.

**Importance of Test:** According to Neumann, the common proximal attachment site of the wrist extensors is on or near the lateral epicondyle of the humerus and dorsal border of the ulna. The distal attachments of the extensor carpi radialis longus and brevis are the 2nd and 3rd metacarpals respectively. These muscles are responsible for wrist extension and radial deviation. The extensor carpi ulnaris attaches to the 5th metacarpal and is responsible for wrist extension and ulnar deviation. With tendinopathy, any stretch or contraction of the tissues can potentially reproduce pain. The starting position of the test (elbow flexion, wrist extension, radial deviation, and pronation) places the muscles in a shortened position. The combination of resisted contraction and palpation of the origin of the muscles reproduce the patient's symptoms.

THE

# DASH

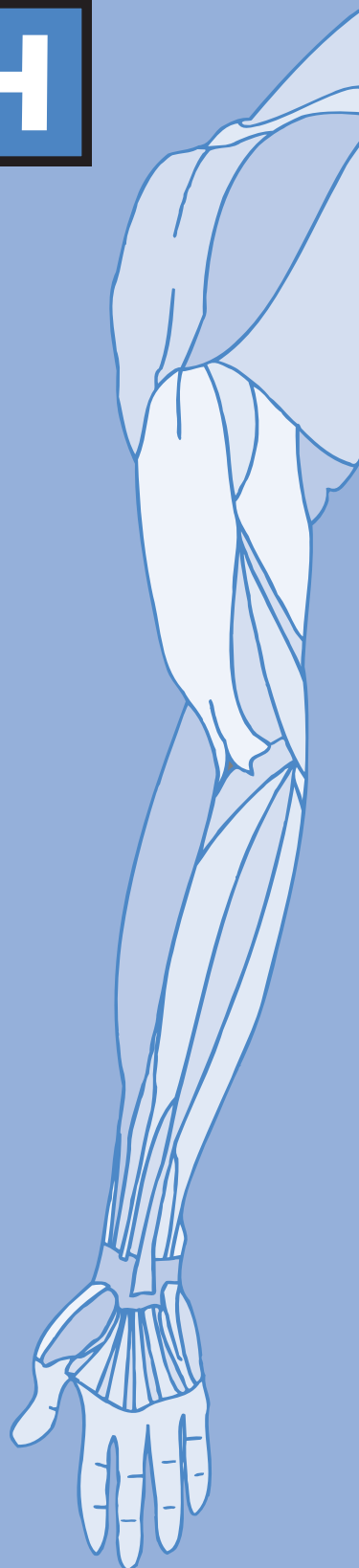
## INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.



# DISABILITIES OF THE ARM, SHOULDER AND HAND

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5

# DISABILITIES OF THE ARM, SHOULDER AND HAND

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, <i>to what extent</i> has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? (circle number)	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? (circle number)	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. (circle number)

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? (circle number)	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. (circle number)	1	2	3	4	5

**DASH DISABILITY/SYMPTOM SCORE** =  $\frac{[(\text{sum of } n \text{ responses}) - 1]}{n} \times 25$ , where n is equal to the number of completed responses.

A DASH score may not be calculated if there are greater than 3 missing items.



# DISABILITIES OF THE ARM, SHOULDER AND HAND

## WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including home-making if that is your main work role).

Please indicate what your job/work is: \_\_\_\_\_

☐ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

## SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you: \_\_\_\_\_

☐ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	1	2	3	4	5
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3. playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4. spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

**SCORING THE OPTIONAL MODULES:** Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.

**An optional module score may not be calculated if there are any missing items.**

## MASTER DATA

S.No.	GROUP A					
	PRE – TEST			POST TEST		
	NPRS	GRIP STRENGTH(Kg)	DASH	NPRS	GRIP STRENGTH(Kg)	DASH
1	5	10	53.3	1	18	32.2
2	9	6	60.8	2	15	35.00
3	8	8	57.5	2	20	33.3
4	6	9	62.5	0	11	36.67
5	4	11	60.84	1	15	37.5
6	7	8	62.5	2	12	35.84
7	8	9	63.64	3	13	34.16
8	8	10	60.83	1	14	35.00
9	7	6	56.57	2	16	32.5
10	5	10	60.84	1	12	34.16
11	4	8	58.53	0	11	38.34
12	9	7	58.34	1	12	40.83
13	6	10	63.00	2	13.5	31.67
14	8	9	60.00	1	15	30.84
15	7	7	57.5	1	13	35.00

GROUP B					
PRE – TEST			POST TEST		
NPRS	GRIP STRENGTH	DASH	NPRS	GRIP STRENGTH(Kg)	DASH
7	8	57.5	1	22	30.8
9	5	61.6	2	20	30.00
6	9	60.00	1	21	34.3
10	7.5	61.67	2	19	34.16
5	10	52.5	1	21	34.67
7	8.5	60.00	1	23	32.5
9	9.5	62.5	2	18	36.67
8	4	56.67	2	19	30.84
6	10	61.67	1	23	34.1
4	9	65.13	0	20	28.33
7	9.5	57.5	2	21.5	35.00
9	8	62.5	1	20	33.34
5	11	53.34	0	22	31.67
8	10	60.84	1	20	36.67
7	9.5	55.84	1	20.5	30.1